mathematical induction and the binomial theorem. The place assigned, as is usual in text-books, to mathematical induction shows how broad is the gulf between psychology and logic. The collection should prove useful.

(4) It is pleasant to read such a practical book as this one. The authors have dealt only with those parts of mathematics which seemed to them to be of real value in practical work, and the whole book is pervaded by the spirit of Prof. Perry. The very form of the questions is refreshingly non-academic: we are concerned with the important things of life—with kilowatts, gearing, and Whitworth standard nuts. It would seem to be a mistake to give (as on p. 257) areas and volumes of certain figures, and then remark:

"The formulæ are proved most conveniently by the aid of more advanced mathematics than need be given in this volume." It warms one's heart to see (p. 5): "*A formula* is practically the simple single statement in general terms of a whole series of particular facts." It seems to us that Prof. Perry and his school are doing much incidentally to help the development of mathematics by opening our eyes to the fact that what Boole called "a premature converse with abstractions" is ruinous for a boy's whole mental life.

(5) Is simply a reproduction of the second part of (6) with a new preface. Whereas the preface of (6) gives a list of the "distinctive features" of the book, (5) states somewhat ambiguously: "Whatever unusual merit the book possesses must be largely sought for in the following points. . . ."

In (6), then, we find that, both in plane and in spherical trigonometry, triangles are solved in detail by graphical methods before analytical methods are presented, and there are many other innovations—thus, Napier's rules are proved and the three fundamental formulæ for the spherical triangle are derived simultaneously. Having read (p. v.): "The references to algebra are limited to those with which every beginner may be reasonably assumed to be familiar," we are surprised to find (p. 278) the imaginary unit defined shortly as the solution of the equation $x^2+1=0$, no evidence having been given that this equation has a solution. After this, we cannot be surprised that there is not the slightest attempt either to point out to the student the very great and fundamental difficulties that there are in the theory of convergence (see especially p. 312) or even to treat the subject correctly. The historical references are sometimes faulty: Wessel was a Dane and not a German; the trigonometrical form of a complex number is due to Euler and not to Cauchy (p. 285).

φ.

OUR BOOKSHELF.

The Schools and the Nation. By Dr. Georg Kerschensteiner. Authorised translation by C. K. Ogden. Pp. xxiv+351. (London: Macmillan and Co., Ltd., 1914.) Price 6*s.* net.

THIS is a book of exceptional interest for all who are engaged in the work of education and for those who are seriously concerned with the future social and economical well-being of the children of the nation.

It is a record of the aims and of the achievements of Dr. Kerschensteiner, of Munich, during the past twenty years in the sphere of continued education for the youth of that city. As a consequence of his assiduous enlightened effort, coupled with the ultimate goodwill of employers and employed, he has been able to establish a complete system of continued trade education for practically all the industries of Munich providing not only for the continued general education up to the close of their eighteenth year of the children leaving the elementary schools, but also for their technical training in industry and commerce combined with instruction bearing upon their daily life and duties and in relation to their future responsibilities as citizens.

The system has been gradually developed, but always in close cooperation with the City Trade Guilds, and its success has been assured by the adoption by the municipality of compulsory measures requiring the attendance of all apprentices and others engaged in employment at the courses provided within the usual working hours.

Special buildings have been erected providing for about fifty-six various industries, chiefly handicraft, many of them demanding much artistic knowledge and skill. This concrete illustration of the successful treatment of the problem of continued education deserves the most serious study.

How Man Conquered Nature. By Minnie J. Reynolds. Pp. v+249. (New York: The Macmillan Company, 1914.) Price 1*s.* 8*d.* net.

THE style of this little book will appeal to children. The language is simple without being babyish. Man's development is traced from the time when, realising the "opposition of the thumb," he threw his first stone, down to his use of a flying machine. Not unnaturally, perhaps, Miss Reynolds, in the first part of the book especially, gives great prominence to woman's part in the civilising process. We are told, for instance, "woman was the first harvester," "the first miller," "the first baker," "the first salt maker," "the first furrier," and so on.

Excelsior School Map of the United States. In four sheets. Size 62 in. by 48 in. (London: G. W. Bacon and Co., Ltd.) Mounted to hang, with rollers and varnished; or mounted, cut to fold, with eyelets. With political colouring, 15*s.*; the same with contour colouring, 16*s.*

THIS wall map is constructed on a conical projection on a scale of 1 : 3,200,000, or 50·5 miles to an inch. It is provided with an inset map of

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the Philippines on a scale of 1 : 7,500,000. The coast-line, rivers and lakes are in blue; the railways and sea-routes, with distances, are in red; and town names are printed in black. The general effect is excellent, and the map should meet the needs of the class-room satisfactorily.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of Nature. *No notice is taken of anonymous communications.]*

Forests and Floods.

Some time ago the question of the effect of forests in checking floods was discussed in the pages of Nature. The subject was lately recalled to my recollection while watching gardening operations in the vegetable borders. I was then much struck by the different conditions, after rainfall, of newly dug ground and ground that had lain undisturbed for a year. The gardener was proceeding to put in plants in the newly dug part, but found it much too wet to be worked in. It was suggested he might continue the digging of the rest of the border and leave the planting until later. On breaking up the undisturbed ground, it was found to be fairly dry and in quite good condition for digging. These conditions seemed to indicate that newly disturbed ground holds a much greater proportion of the rainfall than does consolidated ground in which the soil particles are more closely packed together. In the latter the water seems to pass much more freely through it than in the former, possibly due to there being a continuous water film from the surface to the water table. It not only passes more quickly to the lower level, but much more of it passes, while the disturbed ground retains a much greater proportion of it to the benefit of the vegetation.

Experiments might be made to get further information on this point by means of proper water-tight tanks filled with earth, and comparative readings taken of the drainage water in tanks in which the soil had become consolidated by rainfall and those in which the soil had been recently disturbed. As this would take a long time to accomplish, it has not been done, but perhaps some others may be induced to make the tests, as the knowledge of the subject may be useful in agricultural operations. It does not directly bear on dry farming, as that is a question mostly of surface soil mulch produced by stirring the surface soil and so breaking the water film connecting it with the subsoil. But it would seem to indicate that before dry farming can be started, the surface soil, to a depth sufficient to hold the rainfall, should first be thoroughly pulverised to prevent the rainfall passing downwards and beyond the range of the roots.

Though satisfactory tests have not been made yet I had an opportunity of making some experiments on somewhat similar lines. There were three pots full of soil lying out in the garden. These had previously been in use in some experiments with plants. The soil in all of them was alike, having been taken from the kitchen garden. These pots and soil had been lying out for more than a year; and as the soil in them was thoroughly consolidated, the question was put to them. First, the pots were all weighed; as the weather had been fine for some time, the soil was pretty dry. The pot having the medium weight was then selected, the soil emptied out, broken up, and returned to the pot. Water was now poured slowly over the soil in all the pots in 4-oz. doses at a time. The first thing noticed was that the water entered the soil of the undisturbed pots more slowly than the other, and, secondly, that the water came more quickly through the soil in these pots than through the other. Water was added to the pots until they ceased to take up any more. After draining, they were weighed again, and the result is given in the table:—

Weights in Pounds and Ounces of the Three Pots.

	No. 1. Consolidated soil		No. 2. Pulverised soil		No. 3. Consolidated soil	
	lb.	oz.	lb.	oz.	lb.	oz.
Dry … …	7	9½	7	10	7	13
Wet … …	8	10	9	6½	9	1
Water held by soil	1	0½	1	12½	1	4

It may be further mentioned that it was thought that some of the soil in the consolidated pots might not have got thoroughly wetted, owing to the water running quickly through them; the three pots were therefore afterwards put in a vessel of water to soak; they were then drained and weighed, but the result showed but little change, showing that all the pots had got as much water as the soil would hold. An examination of the above table shows that the disturbed soil holds a much greater amount of water than the consolidated soil. No definite conclusion can be drawn from these figures as to the relative retaining powers of the soil in the two conditions, as no two soils are likely to be equally affected. The only thing to be noted is that the pulverised soil has a much greater power of holding water than the consolidated.

It may be asked: what has all this to do with forests and floods? If we are correct in supposing that soil by becoming consolidated and the particles close packed, by the action of the rainfall, causes it first to resist the entrance of heavy rainfalls, and secondly, after it has entered the soil, to facilitate its passage through it to depths beyond the range of being of use to vegetation. If this be so, then anything that breaks up the close packing of the grains and stirs the soil will tend to enable the water to enter the soil, and will also tend to enable it to retain it. Now the roots of trees in forests, by their constant growth and expansion, stir the soil and prevent it getting consolidated. The soil under trees will therefore always be in the best condition for absorbing and retaining the rainfall. And the surplus is only slowly parted with to feed the drainage, whereas on bare soil, or soil on which the vegetation is poor, tends to reject the rainfall, causing the water to run off the surface, and what enters is quickly passed downwards to swell the drainage water. From the above it would appear that bare and poorly cultivated land will tend to cause floods by speedily getting quit of its rainfall, while forest land will retain and only slowly part with it. The decaying vegetation on the surface under trees has also a beneficial effect, as it absorbs water and acts as a mulch, preventing drying.

It is well known that rains in early summer, unless when torrential, give rise to small amounts of flooding compared with winter rains of the same amount. There are a number of reasons for this which our space does not admit of treating, but it is probably in part due to the stirring action on the soil of the roots of grasses and other plants, as that is the season when root action is most active.

Ardenlea, Falkirk. John Aitken.
June 29.

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